REMARKS

The Office Action mailed September 21, 2005, has been carefully reviewed and, by this Amendment, Applicant has canceled claims 9 and 17-20, amended claims 1, 2, 4-8, and 11-15, and added claims 21-42. Claims 1-8, 10-16 and 21-42 are pending in the application. Claims 1, 11, 27 and 38 are independent.

As an initial matter, Applicants have certain clarifying changes to the specification. Entry thereof is requested.

The Examiner rejected claims 1, 4 and 8 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 4,903,635 to Hebrank, and rejected claims 11, 12, 16 and 17 as being anticipated by U.S. Patent No. 6,032,612 to Williams. Under 35 U.S.C. 103(a), the Examiner rejected claims 2 and 3 as being unpatentable over Hebrank in view of U.S. Patent No. 1,191,061 to Carter, rejected claims 5-7, 9 and 10 as being unpatentable over Hebrank, rejected claims 13 and 14 as being unpatentable over Williams in view of Carter, and rejected claim 15 as being unpatentable over Williams.

As set forth in amended claim 1, the claimed invention is directed to an apparatus for delivering a predetermined volume of liquid to a delivery site. The apparatus includes a body that defines a liquid pressure chamber and a pneumatic pressure chamber, with these two chambers being separated *from one another* by a

flexible membrane member. A liquid channel in the body connects the liquid pressure chamber to a delivery port in order to deliver liquid to the corresponding delivery site.

To control fluid flow, a pair of valves are provided, with the valve downstream of the liquid pressure chamber being *pneumatically operated*. When the liquid pressure chamber is filled with liquid and pneumatic pressure is exerted on the flexible membrane via the pneumatic pressure chamber, the flexible membrane flexes to exert pressure on the liquid in the liquid pressure chamber. As a result of this pressure, when the incoming (upstream) valve is closed and the outgoing (downstream) valve is open, a prescribed volume of liquid is delivered through the liquid channel to and out of the delivery port. This is not shown or suggested by Hebrank.

Hebrank teaches a syringe-type pump 51 operated by a pump drive plate 52 which drives a syringe plunger 53 (see column 6, lines 9-17). The syringe or plunger is recycled by a plunger return spring 54 after the drive plate returns to its uppermost position as shown in Figure 3.

Hebrank does not disclose a liquid pressure chamber and a pneumatic pressure chamber *separated from one another* by a flexible membrane. Nor is such a structure suggested by Hebrank's

syringe or plunger-type mechanism inside the pump 51. Further, the spring 53 does not separate the top and the bottom of pump 51 *from each other*, but simply runs through the center of both. Hebrank discloses a conventional syringe-type or plunger-type delivery system, whereas the present invention has no mechanically movable parts and is operated by external sequencing controls and pneumatic pressure.

For at least the foregoing reasons, claim 1 as amended herein is patentable over the prior art. Favorable reconsideration is requested.

As set forth in amended claim 11, the claimed invention is directed to an apparatus for delivering a fixed volume of liquid to a plurality of delivery sites, the apparatus having a valve body defining a plurality of liquid channels, each connected to a separate delivery port. Fluid dosage chambers are respectively associated with the plurality of liquid channels, each chamber having a specified volume to measure a fixed volume of liquid to be repeatedly delivered out of each delivery port. Hence, *the fixed volume of liquid is determined by the specified fluid dosage chamber volume*.

Additionally, each liquid channel has a *first valve* in advance of its respective fluid dosage chamber to transfer liquid

into the chamber when the first valve is open, and a *second valve* between said respective fluid dosage chamber and its respective delivery port to transfer liquid out of the fluid dosage chamber and to the delivery port when the second valve is open and pneumatic pressure is applied in the fluid dosage chamber. This cooperative operation of two valves per liquid channel is not shown or suggested by Williams.

Williams teaches that dosage is determined by a pump (column 3, lines 24-27 and 62-66) and *not* by the volume of the fluid dosage chamber, i.e., not by the volume of the first and second containers 110, 140, 120. In addition, Williams discloses *only one valve* per channel with nothing to suggest the inclusion of two valves per channel, one before and one after the fluid dosage chamber with complementary operation in opening and closing to effect the desired transfer of liquid into and out of the fluid dosage chamber, as is set forth in claim 11. Accordingly, claim 11 is patentable over Williams.

As set forth in new claim 27, the claimed invention is directed to an apparatus for delivering a fixed volume of liquid simultaneously to multiple delivery sites. The device includes a valve body defining multiple liquid channels individually connected to multiple delivery ports, respectively, and a common delivery

channel for delivering liquid to an input of each of these multiple liquid channels. At least one *pneumatically operated* valve is operatively associated with each liquid channel, the valve including a generally *cone-shaped flexible valve element extending into the liquid channel* and an aligned cutout in the valve body for receiving an outside tip of the generally cone-shaped flexible valve element. A common high-pressure pneumatic channel is pneumatically connected to each of the cone-shaped flexible valve elements to deliver high-pressure to an inside surface of the cone-shaped flexible valve elements to force the outside tip of the cone-shaped flexible valve elements into the aligned cutouts to simultaneously close the valves. When pneumatic pressure is released in the common pneumatic channel to simultaneously open the valves, a fixed volume of liquid is delivered out of each of the delivery ports. This is not shown by Hebrank or Williams, whether these prior art patents are taken alone or in combination.

Finally, new claim 38 is in condition for allowance for at least the reasons already discussed in connection with claims 1, 11 and 27. Furthermore, the prior art does not disclose or suggest an apparatus for delivering a fixed volume of liquid to a plurality of delivery sites, the apparatus having a valve body that defines a plurality of liquid channels connected to a plurality of separate

delivery ports, respectively, with a single liquid reservoir for delivering liquid to each of the liquid channels. As in claim 11, each liquid channel has an associated fluid dosage chamber with a specified volume that defines a fixed volume of liquid to be repeatedly delivered out of its respective delivery port, with the fixed volume of liquid *being determined by the specified fluid dosage chamber volume*.

The liquid channels *each* have *first and second pneumatically operated valves*, the first valve in advance of the respective fluid dosage chamber to transfer liquid into the chamber when the first valve is open, and the second valve between the respective fluid dosage chamber and the delivery port to transfer liquid out of the fluid dosage chamber and to the delivery port when the second valve is open and pneumatic pressure is applied in the fluid dosage chamber.

Finally, a *flexible member* is associated with the fluid dosage chambers *which is in contact with liquid contained therein*, the flexible member forming a side of the chambers. The flexible member flexes in a first direction when liquid is delivered to the liquid channels from the reservoir, the movement enabling the chamber to obtain its full specified volume when the flexible member has moved fully in the first direction. The flexible member

also flexes in a second direction, which is substantially opposite the first direction, when pneumatic pressure is applied to force the specified volume of liquid out of the fluid dosage chambers and into the delivery ports. This structure is clearly distinguishable from the mechanical plunger operation of Hebrank, as well as the pump-controlled dosage mechanism of Williams, neither of which patents disclose a flexible membrane member, two pneumatically operated valves per fluid channel, or a fluid dosage chamber the volume of which defines a fixed volume of liquid to be delivered from an associated delivery port. Favorable consideration and allowance of claim 38 is therefore requested.

Claims 2-8, 10, 12-16, 21-26 and 28-37 and 39-42 are in condition for allowance as claims properly dependent on an allowable base claim and for the subject matter contained therein.

More particularly, as set forth in amended claim 2, the prior art does not disclose a manifold that *distributes fluid* from the liquid pressure chamber to a plurality of ports. Rather, Hebrank's "manifold" is only a structural support in the form of base plate 44 through which each punch and associated needle pass. Nor does the prior art disclose a liquid pressure chamber and a pneumatic pressure chamber having mating elongated openings which are *separated and closed by* the flexible member, as provided in

claim 4. Reconsideration and withdrawal of the rejection of claims 2 and 4 is therefore requested.

With respect to the new dependent claims, claim 21, 24, 25, 28, 37, 40 and 41 variously set forth that the delivery apparatus includes a high pressure manifold coupled to a first side of a valve body and a low pressure manifold coupled to a second side thereof. The high pressure manifold has a plurality of generally circular cutouts in alignment with a corresponding plurality of generally circular openings in the first side, and a plurality of flexible valve elements are secured between respectively aligned cutouts of the first side and the high pressure manifold to form the first and second valves which transfer fluid flow through the liquid channels. The prior art does not show or suggest such a fluid delivery apparatus with high and low pressure manifolds as claimed.

Nor does the prior art teach that the valves are aligned in an upper row and a lower row, or that the low pressure manifold includes a plurality of cutouts positioned to align with a corresponding plurality of generally circular cutouts in the second side of the valve body to form an intermediate row of aligned cutouts that is generally parallel with the upper and lower rows and positioned therebetween, as variously provided in claims 22,

23, 33, 35, 37, 40 and 41. The securing of the flexible membrane between the cutouts of the second side and the low pressure manifold such that the liquid dosage chambers are bounded by the membrane and the second side cutouts as set forth in claims 23 and 41, and the flexible member being further specified as being a unitary member that extends longitudinally to form a dividing wall between the low pressure manifold cutouts and the second side cutouts as in claim 26, further distinguishes the claimed structure of the present invention over the prior art.

The liquid channels passing through a central portion of the valve body to define a generally linear flow, each liquid channel intersecting a respective first valve, a respective fluid dosage chamber and a respective second valve before reaching a respective delivery port, is also not shown in the prior art, placing claim 25 in condition for allowance.

Finally, the inclusion of two valves per fluid channel, whether as in the embodiment shown in Figures 25-28 (claims 29 and 30 being specifically directed thereto), the embodiment shown in Figures 29-32 (claims 31 and 32 being specifically directed thereto), or the embodiment shown in Figures 48-50 (claims 28 and 33-37 being specifically directed thereto), is not taught or

suggested by the prior art. Favorable consideration and allowance of the dependent claims is therefore requested.

With this amendment and the foregoing remarks, it is respectfully submitted that the present application is in condition for allowance. Should the Examiner have any questions or comments, the Examiner is cordially invited to telephone the undersigned attorney so that the present application can receive an early Notice of Allowance.

Respectfully submitted,

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